

IN THE CLAIMS:

The text of all pending claims, (including withdrawn claims) is set forth below. Cancelled and not entered claims are indicated with claim number and status only. The claims as listed below show added text with underlining and deleted text with ~~striketrough~~. The status of each claim is indicated with one of (original), (currently amended), (cancelled), (withdrawn), (new), (previously presented), or (not entered). Please AMEND claims * and ADD new claims * in accordance with the following:

1-2. (canceled)

3. (previously presented) An image processing apparatus, comprising:

a background judgment device judging whether a target pixel is a background pixel using a gray level difference and a standard deviation of gray levels of pixels in a vicinity area of the target pixel on receipt of a multilevel image, wherein

the gray level difference is an amount which is calculated based on a difference between an average gray level of white pixels in the vicinity area of the target pixel and an average gray level of black pixels in the vicinity area of the target pixel.

4. (original) An image processing apparatus, comprising:

a background judgment device judging for each target pixel whether the target pixel is a background pixel on receipt of a multilevel image; and

a local binarization device locally binarizing the target pixel, judging which of a background and a stroke the target pixel belongs to, and outputting a binary image if it is judged that the target pixel is not the background pixel.

5. (original) The apparatus according to claim 4, wherein

said local binarization device uses an amount which is calculated based on an average and a standard deviation of gray levels of pixels in the vicinity area of the target pixel as a binarization threshold for the target pixel.

6. (original) The apparatus according to claim 5, wherein

the amount which is calculated based on the average and the standard deviation of the gray levels of the pixels in the vicinity area of the target pixel is calculated based on a sum of the average and a constant-multiple of the standard deviation.

7. (original) The apparatus according to claim 5, wherein the vicinity area of the target pixel is a rectangular area of $N \times N$ with a prescribed number of pixels N and the target pixel located at a center.
8. (original) The apparatus according to claim 4, wherein said background judgment device judges whether the target pixel is the background pixel, using a standard deviation of gray levels of pixels in the vicinity area of the target pixel.
9. (original) The apparatus according to claim 8, wherein said background judgment device judges whether the target pixel is the background pixel under a background judgment condition of $\sigma < \sigma_{\min}$ with σ as the standard deviation in the vicinity area of the target pixel and σ_{\min} as a prescribed constant.
10. (original) The apparatus according to claim 4, wherein said background judgment device judges whether the target pixel is the background pixel using a standard deviation of gray levels and a gray level difference of pixels in the vicinity area of the target pixel.
11. (previously presented) An image processing apparatus, comprising:
a background judgment device judging for each target pixel whether the target pixel is a background pixel on receipt of a multilevel image; and
a local binarization device locally binarizing the target pixel, judging which of a background and a stroke the target pixel belongs to, and outputting a binary image if it is judged that the target pixel is not the background pixel,
wherein said background judgment device judges whether the target pixel is the background pixel using a standard deviation of gray levels and a gray level difference of pixels in the vicinity area of the target pixel, and
wherein said background judgment device judges whether the target pixel is the background pixel under a background judgment condition of $r = \sigma / \Delta g < r_{\min}$ with σ as the standard deviation in the vicinity area of the target pixel, Δg as the gray level difference in the vicinity of the target pixel and r_{\min} as a prescribed constant.
12. (original) The apparatus according to claim 10, wherein

said background judgment device judges whether the target pixel is the background pixel under a background judgment condition of $\Delta g < \Delta g_{\min}$ with Δg as the gray level difference in the vicinity of the target pixel and Δg_{\min} as a prescribed constant

13. (original) The apparatus according to claim 10, wherein
the gray level difference is an amount which is calculated based on a difference between an average gray level of white pixels in the vicinity area of the target pixel and an average gray level of black pixels in the vicinity area of the target pixel.

14. (previously presented) An image processing apparatus, comprising:
a background judgment device judging for each target pixel whether the target pixel is a background pixel on receipt of a multilevel image; and
a local binarization device locally binarizing the target pixel, judging which of a background and a stroke the target pixel belongs to, and outputting a binary image if it is judged that the target pixel is not the background pixel, wherein said background judgment device judges whether the target pixel is the background pixel using a standard deviation of gray levels and a gray level difference of pixels in the vicinity area of the target pixel, and
wherein said background judgment device judges whether the target pixel is a background pixel using a combination of a background judgment conditions $\sigma < \sigma_{\min}$, $r = \sigma/\Delta g < r_{\min}$ and $\Delta g < \Delta g_{\min}$ with σ as the standard deviation in the vicinity area of the target pixel, Δg as the gray level difference in the vicinity of the target pixel and σ_{\min} , r_{\min} and Δg_{\min} as a prescribed constant.

15. (original) The apparatus according to claim 4, further comprising:
a line element restriction device executing a process of the obtained binary image based on a ratio of black pixels in a shape-fixed line element mask including the target pixel and outputting a binary image.

16. (original) The apparatus according to claim 15, wherein
said line element restriction device leaves the black pixels in the line element mask as black pixels if the ratio of black pixels in the line element mask is a prescribed ratio or more.

17. (original) The apparatus according to claim 15, wherein
said line element restriction device converts all pixels in the line element mask into black

pixels if the ratio of black pixels in the line element mask is a prescribed ratio or more.

18. (original) The apparatus according to claim 15, wherein said line element restriction device converts all pixels in the line element mask into white pixels if the ratio of black pixels in the line element mask is less than a prescribed ratio.

19. (original) The apparatus according to claim 15, wherein said line element restriction device uses a plurality of line element masks.

20. (original) The apparatus according to claim 4, further comprising:
a stroke separation device applying a partial pattern in a gray scale image corresponding to a black pixel joint element in the obtained binary image and separating strokes of different gray levels.

21. (original) The apparatus according to claim 20, wherein said stroke separation device judges whether to perform a stroke separation using one of an inter-class dispersion and a dispersion ratio between different strokes.

22. (original) The apparatus according to claim 4, wherein said local binarization device judges which of the background and the stroke a pixel, which is judged to be the background pixel by said background judgment device, belongs to based on a gray level of the pixel.

23. (original) An image processing method, comprising:
judging for each target pixel whether a target pixel is a background pixel on receipt of a multilevel image; and
locally binarizing the target pixel, judging which of a background and a stroke the target pixel belongs to and outputting a binary image if it is judged that the target pixel is not the background pixel.

24. (original) The method according to claim 23, further comprising:
processing the obtained binary image based on a ratio of black pixels in a shape-fixed line element mask including the target pixel; and
outputting a binary image.

25. (original) The method according to claim 23, further comprising:
binarizing a partial pattern in a gray scale image corresponding to a black pixel joint element in the obtained binary image; and
separating strokes of different gray levels.

26. (original) A computer-readable storage medium on which is recorded a program for enabling a computer extracting a stroke included in an inputted multilevel image to perform a process, said process comprising:

judging for each target pixel whether a target pixel is a background pixel on receipt of a multilevel image; and

locally binarizing the target pixel, judging which of a background and a stroke the target pixel belongs to and outputting a binary image if it is judged that the target pixel is not the background pixel.

27. (original) The storage medium according to claim 26, said process further comprising:

processing the obtained binary image based on a ratio of black pixels in a shape-fixed line element mask including the target pixel; and
outputting a binary image.

28. (original) The storage medium according to claim 26, said process further comprising:

binarizing a partial pattern in a gray scale image corresponding to a black pixel joint element in the obtained binary image; and
separating strokes of different gray levels.

29. (cancelled)

30. (previously presented) An image processing apparatus, comprising:
input means for receiving a multilevel image; and
background judgment means for judging whether a target pixel is a background pixel using a gray level difference and a standard deviation of gray levels of pixels in a vicinity area of the target pixel; wherein

the gray level difference is an amount which is calculated based on a difference between an average gray level of white pixels in the vicinity area of the target pixel and an average gray level of black pixels in the vicinity area of the target pixel.

31. (original) An image processing apparatus, comprising:

background judgment means for judging for each target pixel whether the target pixel is a background pixel on receipt of a multilevel image; and

local binarization means for locally binarizing the target pixel, judging which of a background and a stroke the target pixel belongs to, and outputting a binary image if it is judged that the target pixel is not the background pixel.

32. (original) A transmission signal transmitting to a computer, which extracts a stroke included in an inputted multilevel image, a program for enabling the computer to perform a process, said process comprising:

judging for each target pixel whether a target pixel is a background pixel on receipt of a multilevel image; and

locally binarizing the target pixel, judging which of a background and a stroke the target pixel belongs to and outputting a binary image if it is judged that the target pixel is not the background pixel.

33. (previously presented) An image processing method, comprising:

receiving a multilevel image;

measuring an average gray level of white pixels in a vicinity area of a target pixel of the multilevel image;

measuring an average gray level of black pixels in the vicinity area of the target pixel;

calculating a gray level difference based on a difference between the average gray level of white pixels and the average gray level of black pixels in the vicinity area of the target pixel; and

judging whether the target pixel is a background pixel using the gray level difference and a standard deviation of gray levels of pixels in the vicinity area of the target pixel.